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ABSTRACT

This study investigated the relationship between children's ability to conserve on Piagetian tasks and six measures of the openness of classrooms which comprise the Dimensions of Schooling Questionnaire (DISC): (1) individualization of instruction; (2) student independence; (3) environmental flexibility; (4) nongradedness; (5) flexibility of student evaluation; and (6) flexibility of curricular materials. Teachers of kindergarten, first, second, and mixed grades responded to the questionnaire. The Piagetian tasks were administered to a random sample of three children from each classroom. Three types of conservation tasks were used: substance, length, and number. The correlation between the DISC factor nongradeness was significant. The positive correlation between the nongraded factor and the children's scores on the conservation tasks indicated that the existence of such nongraded instructional patterns is related to better performance on the reasoning tasks used in this study. None of the other correlations between the major variables were found to be significant. (Author/JD)

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CHARACTERISTICS OF CLASSROOM ENVIRONMENTS AND THEIR RELATIONSHIP TO COGNITIVE DEVELOPMENT

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The University of Connecticut, 1977

The purpose of this study was to determine the extent to which some of the characteristics of open classrooms are associated with the cognitive development of children as measured by their performance on certain Piagetian tasks. Specifically, it sought to determine whether the null hypothesis of no significant correlation between the openness of a classroom (total score on the Dimensions of Schooling Questionnaire) and the ability of children in it to conserve can be rejected. Additionally, it ascertained the correlations between six factors which comprise the Dimensions of Schooling Questionnaire: (1) individualization of instruction; (2) student independence; (3) environmental flexibility; (4) nongradedness; (5) flexibility of student evaluation; (6) flexibility of curricular materials, and the ability to conserve length, amount and number.

From a total of 53 lower elementary teachers in the public schools of Grand Haven, Michigan, 33 agreed to participate in the study. This resulted in a sample of classrooms which contained 12 kindergartens, 6 first grades, 5 second grades and 10 mixed grade classes. Each of the teachers responded to the Dimensions of Schooling Questionnaire (DISC) which provided information about their teaching

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practices. The Piagetian tasks were administered to a random sample of three children from each classroom. Three types of conservation tasks were used; substance, length, and number. Each was administered with two different types of materials, resulting in a total of six task administrations.

A Pearson's r was computed between each of the scores on the DISC and the class scores on the Piagetian tasks in order to determine whether there was a significant correlation between these two variables. The same procedure was repeated for each of the factors of the DISC to determine if there was a significant correlation between any of these factors considered separately and performance on the Piagetian tasks. In order to determine the influence of other variables the following correlations were computed: DISC scores and socioeconomic status; DISC scores and age; Piagetian scores and socioeconomic status; and Piagetian scores and age.

Findings. With a single exception, none of the correlations between the major variables was found to be significant. However, the correlation between the DISC factor labled nongradedness and the Piagetian scores was .355 which was found to be significant at the .05 level of confidence. The positive correlation between the nongraded factor of the DISC and the children's scores on the conservation tasks indicated that the existence of such nongraded instructional patterns is related to better performance on the reasoning tasks used in this study.

Similarly, the correlation between DISC scores and socioeconomic status, DISC scores and age, and Piagetian scores and socioeconomic status were not found to be significant. The correlation between the Piagetian scores and age was .583 which was significant at the .01 level of confidence and supports Piaget's findings of improved performance with age.

INTRODUCTION

Amidst the heated debates and in the immense diversity of opinion over open classrooms in the United States, there appears to be one concern which is shared by advocates and skeptics alike. This is the problem of assessing the kinds of gains children make in open classrooms. A survey of the results of existing research reveals a plethora of inconclusive results punctuated intermittently by some rather impressive support for open classrooms.

In general, attempts to assess either the affective or cognitive aspects of open classrooms have been less than spectacular and the resulting sense of dissatisfaction has caused many authors to point to some rather basic assumptions behind research designs as critical factors in the current confusion.[1] These authors point out the contrasts between the scientific method which is the dominant paradigm of research and evaluation, and the beliefs and assumptions underlying open classrooms. Michael Patton's[2] description of the differences between these two models can be summarized by comparing some of the central characteristics of each approach.

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[1] Vito Perrone. Testing and Evaluation: New Views. Washington, D.C.: Association fo. Childhood Education International, 1975.

[2] Michael Quinn Patton. Alternative Evaluation Research Paradigm. Grand Forks: Univ. of N. Dakota Press, 1975

Scientific	Phenomenological
Quantitative	Qualitative
Reliability	Validity
Objectivity	Subjectivity
Distance from data	Closeness to data
Component analysis	Holistic
Outcome evaluations	Process evaluations

In this context, the use of the term scientific is probably a misnomer, since in actuality there is nothing any more scientific about this approach than about many other approaches. Unfortunately, the behavioristic view of education, which focuses upon observable and readily measurable phenomenon, has somehow come to be almost synonymous with the scientific method. More accurately, James B. Macdonald in a critique of evaluation techniques has referred to this as a "technological view" of man and points out that ". . . when we talk technologically about man we objectify him. That is, we abstract from the total potential of the subject or activity some crucial variable and proceed to act as if this is the entirety of the person or activity."[1]

Alternatively, the phenomenological point of view which focuses upon the subjectivity of the learner, is much closer philosophically to the open classroom. Both the phenomenologist and the open classroom advocate share a concern for the non-measurable aspects of man and the necessity for considering the highly individualistic standpoint from which each of us views experience in the light of our past experience. Both might well agree with Macdonald who warns of the consequences that this persistent focus upon the observable, measurable aspects of behavior may have upon curriculum. We can all too easily become

[1] James B. Macdonald. "An Evaluation of Evaluation." Urban Review 7: 3-14; 1974 p. 3.

enmeshed in what he has referred to as a "closed cybernetic loop, where the products of our evaluations will in turn shape our conception of programs in ever smaller and tighter concerns."[1]

Methods of evaluation cannot be divorced from the assumptions about learning and knowledge to which they refer. That is, they do not exist in isolation, but are a means of determining to what extent stated or assumed goals have been reached. It is apparent that divergent goal statements should result in divergent methods of evaluation. Thus a diagramatic representation of the relationship between behavioristic goals and evaluation techniques as opposed to those of the open classroom might look like this:

Behavioristic	Open Classroom
Goals and Assumptions	
1. Performance statements	1. Process statements
2. Emphasis on measurable behavior (i.e. skills)	2. Emphasis on difficult to measure values (social, emotional, aesthetic, moral)
3. Normative standards	3. Subjective, individualistic standards
4. Cognitive growth = accumulation of information	4. Cognitive growth = attainment of advanced forms of reasoning
Evaluation Techniques	
1. Quantitative analysis	1. Qualitative analysis
2. Objective methods	2. Subjective methods
3. Standardized instruments	3. Interview techniques
4. Sampling behaviors out of context (i.e. tests)	4. Observations, anecdotal records, work samples
5. Scoring correctness of responses	5. Seeking reasoning behind responses

What this diagram suggests is that the apparent impotence of existing techniques for assessing development in the open classroom may well stem from incompatibilities in evaluation techniques. An attempt

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[1] Ibid., p. 11

to evaluate a behavioristically designed program will be most meaningful when stated in terms of the behaviors it is designed to facilitate. The application of process evaluation techniques may certainly provide some illuminating information, but does not actually address itself to the stated goals.

On the other hand we have the situation which has commonly been found in the research on open classrooms; that is the evaluation of open programs by behavioristic standards. Again, this certainly does provide information on the performance of the children, but more importantly it does not address itself to the stated goals and standards of the program. It is the author's belief that the application of inappropriate evaluation techniques has frequently been responsible for the sometimes vague and inconclusive results of the assessment of open education programs and that the development and application of relevant evaluation techniques will provide more informative methods of assessing the effectiveness of open programs.

The search for alternative assessment tools has often turned to developmental theories which stress the need for individuals to construct their own knowledge in the process of interacting with their environment. In particular, it has been the work of Jean Piaget which has given form and direction to many of these efforts. Not only has Piaget been instrumental in charting an alternative view of learning and development, but the format of his research, the method clinique, serves as a model for the kind of personal, interactive, in-depth approach that open classroom advocates value so highly.

If it can be established that open classrooms reflect the kinds of learning experiences which Piaget advocates for children, this would

seem to offer logical support for looking at the development of children through a Piagetian framework. In-depth interviews, the observation of children's reasoning in different contexts and with different materials might serve to tap dimensions of learning that are inaccessible by more conventional methods. Furthermore, this would be far more compatible with the learning style fostered in the open classroom which represents such a contrast to the usual testing situation where movement is limited rather than encouraged, where there is reliance on recall rather than experimentation, and stress on paper and pencil tasks rather than the manipulation of concrete objects. Thus it is hoped that such assessment techniques might more truly reflect both the spirit and intent of open classrooms and avoid the inconsistencies which result from the evaluation of one system by the standards of another, an effort comparable to trying to measure water with a ruler.

Statement of the Problem

This investigation will be concerned with the relationship between the openness of a classroom and the cognitive development of children; the extent to which the conditions of an open classroom are associated with the cognitive development of children as measured by their performance on certain types of Piagetian tasks. Specifically stated, is there a correlation between the openness of children's classrooms and their performance on certain Piagetian tasks?

Objectives. The objectives of this study will include:

1. An investigation of the implications of Piaget's theory for curriculum and the extent to which these are incorporated in the open classroom.
2. An attempt to determine whether a given environment is related to

the development of certain aspects of children's thought.

3. An effort to identify specific aspects of an educational environment which may be related to children's cognitive development.

4. An investigation of the qualitative aspect of cognitive development in children as reflected in their ability to apply forms of reasoning described by Piaget, in different contexts and with different materials.

Hypotheses. The study will determine whether the null hypothesis of no significant correlation between the openness of a classroom and the ability of children in it to conserve can be rejected.

Additionally, it will be determined whether we can reject the null hypothesis of no significant correlation between the ability to conserve and each of the six factors which comprise the Dimensions of Schooling Questionnaire: (1) individualization of instruction; (2) student independence, (3) environmental flexibility, (4) non-gradedness, (5) flexibility of student evaluation, (6) flexibility of curricular materials.

Definition of terms.

1. Openness - If the score of a classroom A (as measured by the Dimensions of Schooling Questionnaire) is greater than the score of classroom B, then classroom A is more open than classroom B. Thus the openness of classrooms will be considered as a continuous rather than a dichotomous variable.

2. Conservation - (e.g. of amount) If a child is able to recognize that a quantity remains the same even though its appearance is changed then he is a conserver of amount and will make the appropriate response to Piaget's interview on conservation of amount.

The ability to conserve entails the fundamental idea of reversibility of thought and for Piaget, reversibility is precisely what characterizes the operations of intelligence.

Importance of the Study

When educators pause to consider what Piaget has to offer us it seems that he has been far more generous in supplying us with problems than with answers. Not only has he raised some complex and far-reaching questions in our minds about the way children think, he has persistently declined to give us any pedagogical answers to these questions. Content to confine himself to epistemological questions, Piaget has stated that it is the responsibility of pedagogues to define the pedagogical implications of his work. And considering the immense and profound body of work he has produced, the job of unraveling his complicated skein of thoughts and interweaving them with our own ideas about educational practice will certainly prove to be a long and arduous task.

In the brief comments he has made upon the kind of education which he feels will be most successful in fostering children's development, Piaget has said that it is the "active methods which are alone capable of developing the intellectual personality."[1] Indeed, a comparison of the cluster of seven basic curricular implications which E. D. Evans[2] has derived from Piagetian theory, contrasted with the assumptions behind open education defined by Roland Barth[3] reveal

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[1] Jean Piaget, To Understand is to Invent. New York: Viking Press, 1948, p. 107.

[2] E. D. Evans, Contemporary Influences in Early Childhood Education. New York: Holt, Rinehart and Winston, 1971.

[3] Roland Barth. Open Education. Unpublished doctoral dissertation, Harvard Graduate School of Education, Boston, Mass. 1970.

Evans	Barth
(1) active, self-discovery, inductively oriented learning experiences whereby a child is able to perform transformations on materials from the environment (where direct teaching is necessary it follows rather than precedes periods of manipulation and exploration);	Assumption 16: Intellectual growth and development takes place through a sequence of concrete experiences followed by abstractions. Assumption 17: Verbal abstractions should follow direct experience with objects and ideas not precede them or substitute for them.
(2) arrangement of moderately novel experiences which capitalize upon and facilitate stage-relevant thinking operations, but simultaneously accommodate to the child's present intellectual style;	Assumption 15: Children pass through similar stages of intellectual development, each in his own way and at his own rate and in his own time.
(3) a variety of patterned and enriched concrete sensory experience;	Assumption 5: Active exploration in a rich environment, offering a wide array of manipulative materials will facilitate learning.
(4) the symbolization of manipulative, play and aesthetic experiences;	Assumption 6: Play is not distinguished from work as the predominant mode of learning in early childhood.
(5) provision of a wide variety of models for imitative learning;	Assumption 14: Children learn and develop intellectually not only at their own rate but in their own style

(6) a high rate of interpersonal interaction among children with ample opportunity for role playing, sharing of different viewpoints, and corrective discussions led by adults under appropriate circumstances.

Assumption 11: When two or more children are interested in exploring the same problem or the same materials, they will often choose to collaborate in some way.
Assumption 12: When a child learns something which is important to him, he will wish to share it with others.

(7) the use of clinical method to study children's progress . . .

Assumption 29: It is possible, even likely that an individual may learn or possess knowledge of a phenomenon and yet be unable to display it publicly. Knowledge resides with the knower, not in its public expression.

strong and substantial areas of agreement. In fact, it is this author's belief that because the characteristics of a desirable learning environment suggested by Piaget's research so closely fit the open classroom, it would be worthwhile to investigate the relationship between children's cognitive functioning and characteristics which are indicative of the openness of their classroom.

Furthermore, it is hoped that this study will make a significant contribution to the field by exploring ways in which children's cognitive development might be investigated apart from the administration of standardized achievement tests and will respond to the directions from research in the following ways:

(1) by exploring the implications of Piaget's theory of conceptual development for education;

(2) by providing some information on the impact of relatively long range and extensive types of experience on children's conceptual development;

(3) by attempting to identify the relationships which exist between specific characteristics of a classroom environment and the development of logical operations in children. Hopefully this will be a step toward the future development of learning environments which will be most conducive to optimal growth for children.

Limitations

Because this is a correlational study it will not be possible to draw causal inferences from the relationships existing between the independent and the dependent variables. Only the magnitude and the direction of this relationship can be determined. However, it is

hoped that exploratory research of this type will help to lay the foundation for further studies which might be able to establish causal relationships.

Two aspects of selection which are recognized as possible source of bias would be the existence of basic differences between volunteers and nonvolunteers as participants in the study, or basic differences between children enrolled in open and traditional classrooms. It is hoped that the former will be minimal and that the latter can be controlled by avoiding the use of voluntary enrollment open classrooms.

PROCEDURE AND METHODOLOGY

This study is an investigation of the relationship between certain instructional patterns which exist in a group of early elementary classrooms, and the ability of the children in these classrooms to respond to tasks of logical reasoning.

Sampling

The study was conducted in a small, essentially middleclass town in Western Michigan (population 11,844). An attempt was made to enlist the cooperation of as many teachers as possible within a single school district. From a total of fifty-three teachers in thirteen schools, thirty-three teachers from ten schools agreed to participate in the study. This resulted in a sample which contained twelve kindergarten classes, six first grades, five second grades and ten mixed grade classes.

The sample was restricted to early elementary classrooms (K-2) because children at this age are in the period of transition from preoperational to concrete operational thought. There are indications from the research that children in such a transitional period are more susceptible to the effects of intervention and it was felt that during this period their scores might be more likely to reflect the impact of their instructional environment. Secondly, as children grow older they will all be able to respond correctly to the conservation interviews and would probably ceiling out on the tasks, thus obscuring

any developmental differences which might have existed.

Participation of the teachers in the study required that they complete a questionnaire which provided information about their classrooms (The Dimensions of Schooling Questionnaire) and allow a random sample of three children in their classes to be interviewed with the logical reasoning tasks. The responses of the teachers on the Dimensions of Schooling Questionnaire were verified through personal knowledge of the teaching techniques of the respondents, or by confirmation from the principals of the schools.

In discussion with the principals of the various buildings, the schools and classrooms were classified according to Lloyd Warner's[1] socioeconomic scale. As indicated in Table 1, classrooms in this sample were found to range from lower-lower class to upper-middle class, but no classrooms were designated as lower-upper or upper-upper.

TABLE 1

SOCIOECONOMIC STATUS OF THE SCHOOLS

School	Number of Classes	SES
A	5	upper-lower
B	3	lower-lower
C	2	lower-middle
D	4	lower-middle
E	1	lower-middle
F	3	lower-middle
G	4	upper-middle
H	3	lower-middle
I	4	upper-lower
J	2	upper-lower

[1] Lloyd W. Warner and Paul S. Lunt. The Social Life of a Modern Community. New Haven: Yale University Press, 1941.

While there were some upper-class children in the classrooms, there were not enough that the entire class could be characterized as such. In general, few of the children in the highest socioeconomic classes can be expected to be found in the public schools, so it was not particularly surprising that none of the classrooms were so designated.

In all, there were ninety-nine students who were interviewed with the Piagetian tasks. These students ranged in age from 66 months to 101 months and the mean age was slightly over 83 months.

It must be remembered that for the purposes of this study each classroom is considered as the smallest independent unit of treatment. Thus socioeconomic classification as well as other measures were usually stated in terms of classes as a whole rather than as individuals. Accordingly, two basic scores were obtained on each classroom unit. One was the score on the Dimensions of Schooling Questionnaire, while the other was the total score of a random sample of three children who were interviewed with the tasks of logical reasoning. In all cases, a single score represented the classroom unit.

Design

Two methods were used to gather information in this study. The Dimensions of Schooling Questionnaire (DISC) was used to provide a measure of certain specific characteristics of classroom environments. It inquires about individualization of instruction, student independence, flexibility of materials, environmental flexibility, nongradedness and flexibility of student evaluation. It provides as well a total score which is a general measure of the openness of the class-

room.

The children's development in logical reasoning was assessed through the use of Piagetian interviews; conservation tasks with several different kinds of materials. The tasks were administered on an individual basis and the order in which they were presented was rotated. The time of each administration was recorded in order to insure an equal distribution of morning and afternoon task administrations.

Several potential sources of extraneous variance are recognized in this design. The use of volunteers may bias the sample somewhat, but since such a large percentage of the teachers did agree to participate in the study this factor would be minimal. Through the use of a partial correlation, variables such as age and socioeconomic status which may also influence the results, can be controlled.

Instrumentation

Two instruments were used in this study, one to measure the openness of the classrooms and the other to assess the children's performance on the Piagetian tasks.

Dimensions of Schooling Questionnaire. Developed and refined at the Ontario Institute for Studies in Education, the validity of this instrument was established by several methods. It was based upon characteristics of open education gleaned from the works of noted authors on this subject. One criteria which had to be satisfied before any of these characteristics were included in the instrument was that it could not contradict any of Barth's assumptions about open education. These items were further subjected to the scrutiny of a team of educational experts from a variety of backgrounds, particularly

those with experience in open schools.

In order to provide some empirical evidence of the instrument's validity it was field-tested in two extreme situations: an exemplar open school and an exemplar traditional school. The mean scores obtained by the 10 teachers in the open school was 20.18 with a standard deviation of 1.30. The mean score of the 16 teachers in the traditional school was 11.27 with a standard deviation of 2.17. There was no overlap of the distribution of the scores in the open and the traditional classrooms.

An estimate of the reliability of the instrument was obtained by calculating coefficient alpha, an internal consistency estimate. The reliability coefficient for all teachers was .81.

There are 29 items on the DISC with a range of possible scores of 0 to 29. The instructions for this instrument ask that teachers respond to the items in terms of what actually happens in their school situations rather than in terms of what they think should happen. DISC items inquire about such things as how time is structured, how rules are made, what curriculum materials are available, and how they are used. Teachers do not have to give a single response but have the option of choosing several responses and ranking them according to their relative importance.

A factor analysis of the DISC yielded six factors which have been identified as (1) individualization of instruction, (2) student independence, (3) environmental flexibility, (4) nongradedness, (5) flexibility of student evaluation and (6) flexibility of curricular materials. A score for each of these six factors was computed for each teacher in

addition to the total DISC score.

Piagetian tasks. A desire to measure abilities which would be closely related to the school curriculum led to the selection of three types of conservation tasks; substance, length, and number. Each was administered with two different types of materials.

1. Conservation of number
   A. Bubble gum and pennies
   B. Poker chips of two colors

2. Conservation of length
   A. Yarn
   B. Pencils

3. Conservation of substance
   A. Clay
   B. Licorice

Procedures for administration of the tasks and evaluation of the responses followed the procedures described in Let's Look at Children which is currently being developed at the Educational Testing Service by Bussis and Chittenden (see appendix).* Responses were scored as either conservation, transitional, or nonconservation. Children were asked to provide verbal justification for their responses. In order to be considered a conserver it was necessary to respond to all parts of the task correctly and to demonstrate reversibility of thought as indicated in the guide to interpretation of the responses.

Each of the six tasks was scored as follows:

0 = nonconservation

1 = transitional

2 = conservation

This yields a score range per task of 0 to 2 and a total score range for each individual of 0 to 12.

*Appendix not attached.

Administration of the Instruments. The Dimensions of Schooling Questionnaires were distributed to all teachers in kindergarten through second grade early in the school year with a request that they participate in the study by completing the questionnaire and by allowing children in their classrooms to be interviewed. The Piagetian interviews were conducted in April and May of that school year by a student in education who had been trained by the author to administer the tasks and to record the children's responses. Interviews were conducted on an individual basis and took place during school time in a small room apart from the classroom situation. The order of the task administration was rotated in order to eliminate the influence of a particular task order.

By the close of the school year, teacher questionnaires from thirty-three classrooms had been received. A random sample of three children from each of these classrooms had been interviewed with the Piagetian tasks.

Statistical Procedures. A Pearson's r was computed between the independent variable (score on the teacher questionnaire) and the dependent variable (score on the Piagetian tasks) to determine if there was a significant correlation between these two variables. The same procedure was repeated for each factor of the teacher questionnaire to determine if there was a significant correlation between any of these factors considered separately and performance on the Piagetian tasks.

In addition, two other correlations were computed in an effort to control extraneous variables. The correlation between age and the

openness of the classrooms was computed to determine if it was necessary to control for the effects of age through the use of a partial correlation, holding the effects of age constant. Similarly, the correlation between socioeconomic status and the openness of the classrooms was computed to determine if it was necessary to control for this factor through the use of a partial correlation.

CHAPTER IV

THE RESULTS OF THE STUDY

It is the intent of this study, as stated in Chapter I, to do the following:

(1) investigate the implications of Piaget's theory for curriculum and the extent to which these elements are incorporated in the open classroom;

(2) determine whether a given environment is related to the development of specific aspects of children's thought;

(3) identify specific aspects of an educational environment which may be related to children's cognitive development;

(4) investigate the cognitive development of children as reflected in their ability to apply forms of reasoning described by Piaget, in different contexts, with different materials.

Specifically, it seeks to determine whether there is a correlation between children's performance on Piagetian tasks and certain aspects of classroom instructional patterns as measured by the Dimensions of Schooling Questionnaire. A total score which is a general measure of the openness of the classroom was obtained from the DISC (Dimensions of Schooling Questionnaire) as well as six specific factor scores: (1) individualization of instruction; (2) student independence; (3) environmental flexibility; (4) nongradedness;

(5) flexibility of student evaluation; and (6) flexibility of curricular materials.

For the purpose of this study, classrooms and not individual children have been considered to be the smallest independent units of treatment. Thus, although ninety-nine children were interviewed, the scores of the three children who were randomly drawn from each classroom were used to arrive at a total conservation score for each of the thirty-three classrooms in the study. While the major analysis of the results will consider the data in this manner, it is thought that apart from the central questions involved in the investigation, it might be illuminating to look at the data in other ways. Consequently, in the course of reviewing the results of the instruments, individual scores of the children on the Piagetian tasks have also been analyzed in order to provide a more detailed picture of the children's conceptual development.

Results of the Dimensions of Schooling Questionnaire. The responses of the thirty-three teachers who participated in the study by completing the DISC revealed considerable variety in teaching approach within a single school system. The mean score on the DISC was 12.39, which then compared with the 11.27 mean score of teachers in the exemplar traditional school cited by Traub in the validating studies on the DISC, indicates that these teachers on the whole were a fairly traditional group.

However, the range of scores from 7.06 to 22.06 reveals a tremendous diversity of scores within this group. It might be added that there has been considerable, if not overwhelming interest in open techniques in this district. In the past few years there has been a

series of extension courses provided by a local university dealing with informal teaching methods and these have been widely attended. In addition, the district hired a university consultant to hold a series of informative meetings with both parents and teachers in order to acquaint them with informal methods. Thus, there is probably more than average interest in open methods in this district and since there has been a policy of considerable flexibility and building autonomy in these instructional matters it is not surprising that this type of diversity has developed.

In fact, a look at the DISC scores on a building basis indicates some clustering of open and traditional feeling, with one school having a mean DISC score as low as 9.79 and another with a mean score of 17.32. To some extent, this can probably be attributed to the individual philosophies of the principals in the various buildings and a tendency for teachers to transfer to buildings where they feel most comfortable. The extent of the interschool diversity is presented in Table 2 which contains the mean scores of the participating classrooms in each school building.

TABLE 2

MEAN DISC SCORES OF INDIVIDUAL SCHOOLS

School	Number of Classrooms	Mean DISC Score
A	4	14.32
B	3	9.79
C	2	11.78
D	4	17.32
E	1	16.54
F	5	13.80
G	4	10.95
H	3	9.76
I	4	8.41
J	2	12.28
Totals	33	12.39

An interesting aspect of the classrooms participating in this study is the large number of combined grade classrooms. Most of these classrooms were formed not out of a commitment to nongraded instruction, but from practical considerations created by falling enrollments and an effort to balance class size. However, the large number of such classrooms probably does indicate a lack of resistance to this type of classroom grouping and a willingness to look at it as a workable solution to classroom assignments. An analysis of grade-level scores on the DISC, not surprisingly reveals somewhat more open practices at the kindergarten level with a return to more traditional methods in the first grade.

TABLE 3

DISC SCORES FOR VARIOUS GRADE LEVELS

Grade Level	Number of Classrooms	Mean DISC Score
Kindergarten	12	12.26
First	6	10.30
Second	5	11.28
Split Grades	10	14.35

One striking aspect of these scores is the relatively high DISC scores in the combined grade classrooms. It is interesting to speculate whether the presence of a wider age and ability range within a classroom moved the teachers to try more flexible or open methods, or whether teachers who are predisposed to use such methods were simply more willing to take on these mixed-grade rooms. In any event, there does seem to be a pattern of more open practice in this type of classroom.

A comparison of a group of the most open classrooms with a group of the most traditional classrooms reveals that although the children in the open rooms tended to be somewhat younger, they did score higher on the Piagetian tasks. However, these differences were not found to be statistically significant.

TABLE 4

A COMPARISON OF THE TEN MOST OPEN
AND THE TEN MOST TRADITIONAL CLASSROOMS

Variables	Open Class Rooms	Traditional Class Rooms
Mean Age (months)	84.5	85.1
Mean Score on Piagetian Tasks	26.1	23.4
Mean DISC Score	16.48	8.73

A total overview of the results of the DISC indicates a sample of classrooms which range from quite traditional to quite open classrooms. The frequency distribution of these scores presented in Table 4 shows almost two-thirds of the classrooms scoring between 8.00 and 14.00 on the DISC. When compared to the 11.27 mean score of the teachers in the exemplar traditional school studied by Traub, these appear to be fairly typical traditional classrooms.

TABLE 5

FREQUENCY DISTRIBUTION OF DISC SCORES

Score Range	Number of Classrooms
6.00-8.00	3
8.00-10.00	7
10.00-12.00	5
12.00-14.00	7
14.00-16.00	3
16.00-18.00	4
18.00-20.00	1
20.00-22.00	1

It was also found that classrooms encompassing more than one grade level were somewhat more open than single grade level classrooms. Considerable variation between the schools in terms of the scores of the teachers in that building on the DISC also was found to be characteristic of the sample.

Results of the Piagetian Tasks. The Piagetian tasks consisted of a battery of six tasks which were administered to students on an individual

basis, using an interview technique. Three forms of conservation were assessed; conservation of length, of number, and of amount. Two tasks, using different materials, were used for each form of conservation.

Conservation of Length

1. Bubble gum and pennies
2. Cubes of two colors

Conservation of Number

1. Lengths of yarn
2. Pencils

Conservation of Amount

1. Clay
2. Candy

The scoring procedures resulted in a range of scores of 0-12 for each child. The total possible range of scores on the Piagetian tasks for each classroom was from 0 to 36. In this sample the classroom scores ranged from 4 to 36. The mean score on these tasks was 22.87.

From the total scores on the various tasks it was apparent that all forms of conservation were not of equal difficulty. In fact, a hierarchy of difficulty emerged with conservation of length, in both forms proving to be the most difficult and conservation of number, in both forms the least difficult. The totals of the individual scores for each form of conservation are presented in Table 6.

TABLE 6

THE SUM OF CONSERVATION SCORES FOR INDIVIDUAL TASKS

Conservation Task	Score
Conservation of Number	
1. Bubble gum and pennies	154
2. Colored cubes	155
Total Score	309
Conservation of Substance	
1. Clay	128
2. Candy	122
Total Score	250
Conservation of Length	
1. Yarn	102
2. Pencils	94
Total Score	196

While some studies have found a marked difference between children's performance on intrinsically high interest materials (e.g. candy), this pattern was not replicated in this study. As indicated in Table 6 the children did just as well with colored cubes as they did with bubble gum, and even did slightly worse with candy than they did with clay on the conservation of substance task.

While for the purposes of this study, the classroom was used as the smallest independent unit of treatment and a total Piagetian score was derived for each classroom, nonetheless it is of some interest to

look at the individual performance of the children who were interviewed. The breakdown of the Piagetian scores according to grade level presented in Table 7 reveals the expected improvement of performance on the tasks at higher grade levels. This consistency is more apparent, however, at the upper grade levels, for while students in the second/third grade classrooms never scored lower than six points on the tasks, several children in the kindergarten classrooms did have a perfect score of twelve on the tasks. The range of scores among the older children tends to narrow and one is led to surmise that this group is beginning to ceiling out on the tasks.

TABLE 7

DISTRIBUTION OF CONSERVATION SCORES ACCORDING TO GRADE LEVEL

Score	Grade Level					
	K	1	1/2	2	2/3	Total
0	5	1	1	0	0	7
1	2	0	0	0	0	2
2	5	0	0	0	0	5
3	4	0	1	0	0	5
4	5	1	1	0	0	7
5	1	1	0	0	0	2
6	2	4	2	2	0	10
7	1	1	2	1	1	6
8	1	3	1	1	1	7
9	1	2	1	1	1	6
10	1	1	1	4	1	8
11	2	1	4	3	0	10
12	6	3	4	3	8	24
Totals	36	18	18	15	12	99

Another aspect of the children's performance which was examined was their consistency across materials within a given form of conservation. Were children who were able to conserve length in one context, consistently able to conserve in another? Conversely did children who were unable to conserve, maintain to this pattern of response when confronted with different materials? Since the children were given two tasks in each area it is possible to analyze the consistency of their responses as in Table 8.

TABLE 8

CHILDREN'S RESPONSE CONSISTENCY ON PIAGETIAN TASKS

Response Pattern	Conservation of Number	Conservation of Length	Conservation of Amount
Conserve/ Conserve	65	30	41
Transitional/ Transitional	12	8	6
Nonconserve/ Nonconserve	12	26	18
Mixed Results	10	35	34
Totals	99	99	99

In spite of the large number of children who were consistent in their responses the considerable number of children whose responses were mixed (e.g. conserved with one kind of materials but not with another) indicates a broad pattern of inconsistency across materials. Stimulus variables which might account for this seem almost too complex to identify in this study.

The analysis of sex differences contained in Table 9 indicates practically no appreciable differences in the overall performance of boys and girls on the tasks.

TABLE 9

FREQUENCY DISTRIBUTION OF MALE AND FEMALE PERFORMANCE ON PIAGETIAN TASKS

Score	Number of Males	Number of Females
12	15	9
11	4	6
10	3	5
9	5	1
8	2	5
7	5	1
6	5	5
5	0	2
4	5	2
3	4	1
2	2	2
1	1	2
0	3	4
Mean Score	7.72	7.49

If the Piagetian scores are classified in terms of the socioeconomic status of the children, a pattern of slightly improved performance at higher socioeconomic levels emerges.

TABLE 10

SOCIOECONOMIC STATUS AND SCORES ON THE PIAGETIAN TASKS

Socioeconomic Class	Number of Classrooms	Mean Score
Lower-lower	3	20.33
Upper-lower	11	21.18
Lower-middle	15	23.66
Upper-middle	4	25.5

Influence of the Extraneous Variables. It was stated earlier that this study seeks to determine whether there is a relationship between certain classroom instructional patterns as measured by the DISC and the performance of the children in these classrooms on certain of Piaget's conservation tasks. Prior to the calculation of such correlations it was thought to be necessary to determine the influence of certain extraneous variables which might have an impact upon children's performance. It would then be possible to control these variables through the use of a partial correlation if their influence was considered to be significant. Consideration of the related research led to the identification of two variables which were thought to be important; age, and socioeconomic status.

It was indicated in Table 10 that children from schools which ranked higher on the socioeconomic scale seemed to perform better on the Piagetian tasks, but the correlation between these two factors was found to be only .18 which was not statistically significant.

It was expected that there would be a positive correlation between age and the scores on the Piagetian tasks and in fact there was a .583

correlation between these two factors which was significant at the .01 level of confidence.

Since age is such an important factor in determining Piagetian scores it was important that in the sample, open and traditional classrooms would be comprised of children of approximately the same age, in order that this factor would not bias the results. For this reason, the correlation between DISC scores and the age of the children was computed. There was a slight negative correlation between age and the scores on the DISC (.006), but this was not found to be significant. The lack of a significant correlation indicates that there is no relationship between DISC scores and age. Therefore, we can reasonably expect that children in open and traditional classes would not be essentially different in age.

Since none of the variables which were identified as possible sources of extraneous variance proved to be significant, they were not used in computing the correlation coefficient between the major variables in the study.

Relationship between the results of the instruments. The basic design of this study proposed to determine whether there is a significant correlation between children's performance on Piagetian conservation tasks and the openness of their classrooms as measured by the Dimensions of Schooling Questionnaire. Furthermore, it proposed to determine whether there is a significant correlation between children's performance on the conservation tasks and the six factors of the DISC: individualization of instruction, student independence, environmental flexibility, nongradedness, flexibility of student evaluation and flexibility of curricular materials. Table 11 presents a summary of

the correlation coefficients which were computed between these variables.

TABLE 11

CORRELATIONS BETWEEN DISC SCORES AND PERFORMANCE ON PIAGETIAN CONSERVATION TASKS

DISC Factors	Correlation with Conservation Score	Level of Significance
#1 Individualization of Instruction	.063	N.S.
#2 Student Independence	-.038	N.S.
#3 Environmental Flexibility	.134	N.S.
#4 Nongradedness	.355	.05
#5 Student Evaluation	.023	N.S
#6 Flexibility of Curricular Materials	-.194	N.S.
Total DISC Score	.077	N.S.

As indicated in Table 11, the only factor which was found to be significantly correlated with the children's performance on the conservation tasks was factor #4, nongradedness. At this point it should be added that the relatively restricted range of scores involved in both measures and the relatively small sample both tended to make it less likely that correlations would be significant.

The positive correlation between the nongraded factor on the DISC and the children's scores on the conservation tasks indicates that the

existence of nongraded instructional patterns tends to be related to improvements in children's performance on the reasoning tasks used in this study. The nongraded factor on the DISC is comprised of two items which inquire about vertical organizational patterns and the criteria used to make promotion decisions.

The DISC item labeled Vertical Organization presents the following options for teachers to select.

A. Nongraded provision is made for differentiated rates of progress according to individual needs.

B. A levels system is used—a number of levels are specified in skill subject areas (e.g. 16 reading levels).

C. A unit system is in use (e.g. K-6 units which are progressive in terms of students' achievement).

D. A graded system is in use—provision is made for similar content and rates of progress according to grade level.

The item labeled Criterion for Promotion presents the following choices for teachers.

A. The most important criterion is chronological age.

B. The most important criterion is physical or social maturity.

C. The most important criterion is achievement.

D. The most important criterion is intelligence.

These choices have been ranked in order from most to least open, and teachers are asked to respond by ranking the choices in terms of how well they describe their class situation. However, only the responses which seem appropriate to describe their classroom are ranked. Thus teachers may select more than one option as it seems applicable.

For example, they might respond by ranking achievement as their primary criterion, but then list physical and social maturity and intelligence as second and third in importance. This ranking procedure has the advantage of not forcing teachers into a narrow single choice, but allowing them to respond more flexibly by indicating not only several choices, but also the relative order of their importance.

Teachers whose classrooms were scored as highly nongraded then, have responded that either a totally nongraded provision is made for differential rates of progress, or a somewhat more structured progress through specified levels is provided. Teachers who scored high in terms of their criteria for promotion indicated that factors such as chronological age, or physical and social maturity are of primary importance as opposed to achievement or intelligence when making decisions about promotion.

Two themes seem to emerge from an analysis of the responses. One is a recognition of the differences which exist between students as legitimate patterns of development which are provided for in the curriculum planning of the nongraded teachers. A second is the relatively greater emphasis upon social rather than academic factors in the nongraded classes. Teachers who promote children because of their chronological age usually do so because of an awareness of the social stigma which is often attached to retention and the benefits from allowing children to progress with their age-mates. Conversely, teachers who scored low on these two items have indicated a greater concern for achievement as a basis for instructional groupings and a criterion for development.

Apart from attempting to generalize about the common characteristics of nongraded classrooms which might be relevant to the logical growth of children one might also speculate that the day to day exposure to older children in a mixed-age grouping might have some impact upon the reasoning of the younger children. This would certainly be in accord with Piaget's feelings on the importance of peer interaction and is a phenomenon which has found some support in the research.

While we may speculate on the specific characteristics of nongradedness in classroom situations which would have a significant impact upon the development of children's ability to reason, nonetheless on the basis of these data a definite and significant relationship has been established.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS FOR FURTHER STUDY

One of the basic concerns underlying this research has been a recognition of the need for alternative measures of development. Many people are becoming increasingly concerned about the limitations of standardized testing. Not only humanists who decry the impersonal rigidity of standardized instruments, but even those who are committed to objective and quantitative measures of achievement have become increasingly aware that current standardized tests are not adequate.

The inadequacies of standardized measures have been recounted at length by a number of authors, but for these purposes perhaps it will suffice to summarize some of the inherent biases in these tests. By the nature of their structure, standardized tests favor middle-class children who have language patterns similar to those of the people who constructed the tests. They are biased against unconventional thought patterns; for those children who think creatively or differently are less likely to make the "correct" responses to multiple choice items. They tend to favor quantity rather than quality of thought and responses, for speed rather than depth is the critical factor. The fact that they are a single sample tends to compound the possibility for error, and factors such as the fatigue or distress of a particular day play too large a role.

That there is fairly widespread disillusionment with current testing procedures is brought out in a recent critique of reading

tests by Deborah Meier. In this article she cites Anne Bussis' summary of a 1973 conference of the International Reading Association which revealed "virtually unanimous agreement that all the existing normative-based reading tests were without a theoretical rationale, had 'little relevance for instruction and were not designed to measure or record educational improvement.'"[1]

If we consider some of the assumptions about knowledge and the evaluation of it which are basic to open education, and contrast these with the assumptions about knowledge implicit in the standardized model of evaluation the conflict becomes strikingly apparent.

For those who wish to totally abandon standardized measures of achievement, the development of more subjective, individual techniques is a logical step. But even for those who do not wish to go to this extreme, new techniques which attempt to get at individual logical processes may have considerable value as supplemental measures which would provide additional information on the growth of children's thought.

Standardized measures present certain basic philosophical clashes for open classroom advocates. When a program committed to the development of logical processes, the fostering of social, emotional and aesthetic values on a subjective, individualistic basis is assessed by techniques which are aimed at a quantitative and normative analysis of an arbitrary sample of skills of knowledge, there is a deep and

[1] Deborah Meier. "Another Look at What's Wrong with Reading Tests." Testing and Evaluation: New Views. Monroe D. Cohen, Editor. Washington, D.C.: Association for Childhood Education International. 1975. p. 35.

Open Statements about Evaluation
(Roland Barth)

Children learn and develop intellectually not only at their own rate but in their own style.

The qualities of a person's learning which can be carefully measured are not necessarily the most important.

Objective measures of performance may have a negative effect upon learning.

Learning is best assessed intuitively, by direct observation.

The best way of evaluating the effect of the school experience on the child is to observe him over a long period of time.

It is possible, even likely that an individual may learn and possess knowledge of a phenomenon and yet be unable to display it publicly. Knowledge resides with the knower, not in its public expression.

Statements Implicit in Standardized Measures

There is a single proper rate of growth which can be determined by establishing normative standards.

The qualities of a person's learning which cannot be carefully measured are not real because they are undefinable.

Objective measures of performance are the means by which we can determine whether children's performance is up to standard and take appropriate corrective action if it is not.

Learning is best assessed by professionally developed tests whose reliability and validity have been statistically established.

The best way of evaluating the effect of the school experience on the child is to accumulate standardized data which can be objectively analyzed.

Knowledge which cannot be public displayed is probably not of much value. In fact, its existence is questionable.

basic conflict which appears to be almost irreconcilable. While there is some doubt that objective measures are adequate even to assess objective goals, it seems even more doubtful that these same measures can be applied to the highly subjective, personal goals of the open classroom.

Unfortunately, the desire to improve evaluation techniques is not synonomous with its accomplishment. There are too many difficulties which are inherent in the problem to assume that this could readily be accomplished. The goals of open classrooms are admittedly elusive and difficult to assess. Attitudes, self-concepts, values and feelings are not entities which lend themselves readily to measurement, but are amorphous things which are often revealed only through subtle changes in behavior and perceived only through intimate and prolonged interaction. Objectives such as these are not only difficult to assess, but often difficult to even specifically formulate effectively. The reluctance of many to impose their personal value systems on others has made this problem even more painful.

However concerned one may be about the dangers inherent in standardized evaluation procedures, the need for goals and standards remains. The lack of a coherently stated goal leaves one wandering almost aimlessly about and the lack of standards render us incapable of guiding and directing children's growth and development. It is important that the protest against standard measures of assessing development not be interpreted as a total rejection of goals and standards, but a plea for more flexible goals and standards which are based upon developmental concepts rather than an arbitrary sampling of skills or

knowledge.

By delineating a complete developmental sequence in terms of a hierarchy of increasingly sophisticated states which are believed to be universally applicable, a cognitive-developmental theory such as Piaget's provides an empirical model for assessing growth. But while a developmental approach to learning may well serve as a basis for curriculum development and provide an empirical standard for growth, the question of whether a specific measure of logical development such as Piaget's conservation tasks can be used to determine the effectiveness of a particular method of instruction is another matter.

One of the major problems would be the question of how experience affects development. While acknowledging the role of experience in contributing to development, Piaget also posits a large maturational component which leaves open the question of the relative balance of these two factors. A relatively minor role for experience would imply that gross changes in this factor would probably be necessary to overcome the dominant influence of maturation. Thus the impact of any attempt at altering experiential factors would probably be minimal.

Another problem is the very breadth of Piaget's concept of logical development which must include all the various experiences in which children continuously engage. Are there so many opportunities in the child's life for the exploratory behavior necessary for the construction and verification of logical constructs that it does not make much difference what happens in school?

These are serious considerations which must be a part of any attempt to apply Piaget's theory to educational practice. But in addition to providing an adequate theoretical base for assessing growth,

a cognitive-developmental approach to learning certainly has other significant values. Attention to not only how much information children have acquired, but also to how they acquired it broadens our view of learning. Thinking about children's thinking can add a much needed third dimension to instruction that to this point has really been concerned with only the dimensions; how much, and how fast.

Summary. The task of deriving educational implications from a theory such as Piaget's sometimes leaves us wondering whether teachers and epistemologists have anything to say to each other. The bridges which need to be built between theory and practice have just begun to take shape, but some of their underlying structures have already become quite clear.

One basic structure is the concept of development as a progression through a series of increasingly sophisticated stages. The qualitative differences between children at earlier stages of development are recognized, and taken into account when planning instruction. The goal is to assure healthy progression through the stages, usually through exposure to some form of cognitive conflict.

The necessity for a form of activity which is both physical and intellectual is a second underlying principle. From these general principles are derived the companion needs for direct encounters with the physical world of objects and with the human world in the exchange of ideas through peer interaction. For experience in the physical sense involves the evolution of thought through direct experience with the world of objects, but experience in the intellectual sense refers to encounters with the ideas of others and the growth which occurs in

the reconciling of conflicting elements.

Although there is some agreement regarding the broader implications of Piaget's theory, the specific applications to practice have been varied. For some this has meant the development of Piagetian curriculums which are comprehensive programs designed to explicate a Piagetian view of development. For others this has taken the form of a search for existing programs or the development of new programs which might be compatible with the theory. The latter has been particularly true in the areas of mathematics and science, and the effectiveness of activity based programs such as SCIS and Cuisenaire rods has drawn attention in the research.

Piaget's comments about the educational implications of his work have been sparse indeed, but the few remarks he has been moved to make have stressed the necessity for what he calls the active methods of instruction. It is this author's belief that it is in the open style of instruction that one finds the opportunities for both the physical and intellectual experiences necessary for logical growth. Certainly open classrooms vary immensely, and considering the diversity of form they have taken in practice it sometimes seems difficult to arrive at a consensus of opinion as to what actually constitutes one. Still, uniformity is not a criterion of excellence and there is room for considerable variety of style within this broad framework. Certainly there have been and will continue to be misapplications of the open concepts. Any idea can be corrupted or misconstrued, but the limitations of the practitioners should not be attributed to the idea itself. Whatever misinterpretations might be made in applying such

concepts, they still hold forth the promise of a more active and effective approach to education.

The central focus of this study was the identification of classroom characteristics which are related to logical development. One significant correlation was identified, the relationship between nongradedness and performance on the logical tasks. However, the lack of significant correlations between logical reasoning ability and the other variables does not prove that such a relationship does not exist, merely that it was not detected by this measurement. The small sample size, the limitations of the instruments, the restricted range of scores are all factors which tend to make it difficult to establish significant correlations.

In addition, a developmental view of logical growth implies the recognition of the multiplicity of sources from which growth experiences are derived. School constitutes only a portion of the child's day and the myriad of other activities which comprise that day, during all the child's waking hours, are a part of his or her learning experiences. In contrast to a view of learning which places schooling at the center and looks upon teachers and books as the major sources of information, a developmental view looks at all of life as a learning opportunity. The very breadth of such a concept makes it difficult to have a significant impact upon development by simply altering one facet of it.

On the other hand, relegating schooling to a more minor role should not mean that it is insignificant. If we cannot be omnipotent

at least we can be sure that we do not inhibit development. By encouraging activity and interaction we can facilitate development in the portion of the child's life that is allotted to us.

One of several questions raised in this context concerns the feasibility of using Piagetian measures as an indication of the effectiveness of educational programs. First of all we might be led to wonder whether it is possible to determine the impact of rather specific sorts of experiences such as instructional techniques upon development. Or could only gross deprivation or the remediation of such gross deprivation result in a measurable effect?

Secondly, one wonders whether the maturational component of development is so large and the experiential factors though essential, so relatively weak as to be nonassessable, or at least exceedingly difficult to measure with existing techniques. While not wishing to cast a gloomy pall over further research in this area, nevertheless such limitations are a real possibility and should be kept in mind.

Recommendations for further study. Although the body of research which has been generated by Piaget's theory is already extensive, avenues for further research are so numerous and varied as to be almost unending. Research directions which would be particularly relevant to the questions raised in this study might include the following topics.

1. An investigation of the impact of variables not measured by the DISC. Of particular interest would be studies of the way concrete or manipulative materials are used in classrooms and the effectiveness of techniques which employ such materials. This should include not only studies of programs which use

materials in highly structured ways, such as Cuisenaire rods, but also of situations which simply encourage children to use such materials to express ideas and to facilitate their own thinking.

2. Studies which investigate the impact of peer interaction in classroom settings, particularly over long periods of time. While some studies have focused on the influence of peer interaction on responses to conservation problems there are doubtless more extensive and subtle interactions occurring in peer exchanges which ultimately affect the development of thought processes. A more general inquiry into the impact of peer interaction, especially between varying age groups might be illuminating.

3. Directly relevant to this study would be a further investigation of the specific elements of a nongraded classroom which might be related to logical growth and development.

4. Longitudinal studies designed to determine whether the effects of variables similar to those measured by the DISC might be more noticeable if children had been in nongraded rooms, or open rooms for prolonged periods (e.g. several years).

5. Causal studies which would attempt to establish a relationship between nongraded instruction or other such variables, and performance on Piagetian measures.

6. Certainly, studies designed to help identify instructional variables which are related to the logical development of children would be of enormous value to educators in planning

for instruction. This area seems to be particularly rich in potential. The factors involved are so numerous and varied that it is difficult to imagine all the directions in which this sort of research might lead.

Conclusions. At this point it might be well to reiterate the limitations of this study which have been discussed earlier, but must be kept in mind when attempting to draw conclusions from the data. Because this is a correlational study no attempt will be made to draw causal inferences about the variables which have been studied. Only the magnitude and direction of their relationship can be determined by a study of this nature. In addition, any of the measurements made can be no better than the tools which were used to make them, or the people who used those tools. While every attempt was made to obtain the best possible measure of openness and of the instructional variables, to apply all measures in accord with the prescribed procedures and to encourage the respondents to be as truthful and accurate as possible, still there is always room for biased responses of some sort. The use of volunteer subjects always has the inherent possibility of bias if the volunteers are in some way basically different than non-volunteers. Because this sample represented such a large portion of the early elementary teachers (thirty-three out of fifty-three teachers) in this district the influence of this factor would probably be minimal or nonexistent. Being fully cognizant of these limitations it is possible to draw some rational conclusions from the data accumulated

in this study.

The responses of the participating teachers to the items on the DISC indicate that these are classrooms which are on the whole, fairly typical classrooms. The mean score of the classrooms in this study was 12.39 which was only slightly higher than the 11.27 mean score of the teachers in the exemplar traditional school cited by Traub in the validating studies on the DISC. On the other hand, there was considerable diversity in the scores from teacher to teacher and from building to building. The scores of the teachers ranged from a low of 7.96 to a high of 22.06. The mean scores of the teachers in the various buildings ranged from a low of 8.41 to a high of 17.32. A tendency toward more open practices in the kindergartens and in the split grade classrooms was revealed. With mean scores of 12.16 and 14.35 respectively, these two types of rooms scored higher than any of the other grade levels on the DISC.

The analysis of the scores on the Piagetian tasks has generally supported Piaget's findings. The expected improvement of performance with age was marked. When the mean scores of the various grade levels are compared we see progressive improvement each year. The correlation between age and the scores on the Piagetian tasks was .583 which was significant at the .01 level of confidence. Therefore, we can conclude that improved performance on the tasks was characteristic of older children.

A hierarchy of difficulty also became apparent on the three Piagetian tasks. Conservation of number proved to be the easiest for the children and the total score on these tasks was 309. Conservation

of substance with a total score of 250 was next in difficulty, while conservation of length with a total score of 196 proved to be the most difficult.

Consideration of extraneous variables which might have influenced the findings indicates that differences due to socioeconomic status did seem to exist but were slight. The correlation of .181 between socioeconomic status and the scores on the Piagetian tasks was not found to be significant. Similarly, there were no apparent sex differences in the performance of males and females on the tasks.

The final analysis of the major variables indicated that the correlations between performance on the Piagetian tasks and the DISC measures of individualization of instruction, student independence, environmental flexibility, student evaluation, flexibility of curricular materials and the total openness score were not found to be significant. The correlation between the Piagetian scores and the DISC factor labeled nongradedness was .355 which was found to be significant at the .05 level of confidence. The presence of this significant positive correlation indicates that a child's presence in a nongraded classroom as measured by the Dimensions of Schooling Questionnaire is associated with higher scores on the Piagetian tasks of conservation of substance, length, and number. Analysis of the DISC items on nongradedness indicates that these classrooms are characterized by provision for differentiated rates of progress according to individual needs and by promotional standards which focus on various aspects of children's maturing rather than achievement or

intelligence. We conclude therefore, that the conditions existing in these classrooms are associated with superior performance on these logical reasoning tasks.